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Av Kathleen M.C. Tjørve, Erik Sutterud, Bjørg Midtskogen, Åshild F. Krüger, Neil Fulton, and Stian Ellefsen

Authors

Kathleen M.C. Tjørve
Gjesteforsker ved
Høgskolen i
Lillehammer
kathy.tjorve@hil.no

Erik Sutterud
Avdelingsingeniør ved
Høgskolen i
Lillehammer
erik.sutterud@hil.no

Bjørg Midtskogen
Høgskolelektor ved
Høgskolen i
Lillehammer
bjorg.midtskogen@hil.no

Åshild Frida Krüger
Høgskolelektor ved
Høgskolen i
Lillehammer
ashild.kruger@hil.no

Neil Fulton
Førstekonsulent/høgskolelektor i Avdeling TVF ved Høgskolen i Lillehammer
neil.fulton@hil.no

Stian Ellefsen
Førsteamanuensis ved Høgskolen i Lillehammer
stian.ellefsen@hil.no

The use of technology in teaching: student satisfaction and perceived learning

Abstract: In an age of information and the Internet there is pressure for higher education institutions to use new technologies in delivering learning material. Downloading files («pull» technology) from institutional Internet sites for viewing has been used extensively. Webcasting of lectures for revision purposes and for distance-learning students has been shown to be beneficial in numerous fields. The introduction of iPods and automatic downloads («push» technology) is a new tool in teaching. The aim of this study was to determine student satisfaction and perceived degree of learning from three different types of lecture delivery: a classical auditorium lecture, a full-length film of the lecture and a short and concise, downloadable podcast version of the same lecture content. Through a simple experiment we found that students preferred traditional auditorium lectures over observing the same lecture as a film. We also found that students did not view a shortened podcast version of the lecture (made available as a download in two formats). Consequently, we recommend that lecturers should consider both the purpose and the content of the material they wish to make available to their students before investing their time and resources in creating teaching materials.

Since the start of the millennium, there have been great advances in technology such that the new generation of students is easily able to obtain information online. Surfing the World Wide Web (WWW) is no longer a stationary activity because mobile devices such as laptops, mobile phones and iPods make Internet access possible. Even higher education institutions make wireless Internet available for their students and information communication technologies (ICT) are used as a teaching tool by allowing access to downloadable teaching material (PowerPoint, video, audio, etc.) from institutional web sites (Harris and Krousgrill, 2008). Thus teaching material and information is continually available to a widely dispersed student body, irrespective of time and location (Reynolds et al., 2008).

The changing forms of Mobile learning

Mobile learning or M-learning describes the ability of students to download multimedia files to a portable device for playback, and thus the term incorporates both webcasting and podcasting (Evans, 2007; Shim et al., 2007; Reynolds et al., 2008).

Webcasting is defined as «broadcast video, live or on-demand» availability of media (Reynolds et al., 2008). By making use of Internet-based streaming technologies, it can deliver high quality imaging within any chosen learning environment (Reynolds et al., 2008). This enables teachers to simultaneously deliver lectures in an auditorium and «live» via video conferencing (streaming) to students located off campus. Students therefore view the lecture on the Internet without downloading it onto their computer. Consequently, webcasting enables students and teachers to interact over the Internet, and has improved the learning experience for off-campus or distance-learning students.

Podcasting is defined as video or audio files that are episodic and are sent out by a provider, and typically involves automatic downloading through the use of special client software applications (pod catchers) in addition to being available as a download from the providers Internet site (Shim et al., 2007). It is different to webcasting because podcasts are viewed after downloading; they are typically short and are specialized for use on mobile devices like iPods. Podcasting may be the next stage in webcasting because it adds spatial flexibility to the temporal flexibility offered by webcasting (Shim et al., 2007). In 2008, Harris and Krousgrill noted that more than 100 million iPods had been sold worldwide since their introduction, and they estimated that 70 percent of students attending the major universities in the US owned one. By September 2009 Apple released sales figures for iPods and iPhones as 20 million and 30 million, respectively, and over a million iPads™ were sold in the first month after their release in 2010 (Apple, 2010). Consequently, mobile access to the Internet is increasing rapidly, and this makes access of multimedia from the web for education possible and its use a viable teaching opportunity (Harris and Krousgrill, 2008).

M-learning makes the transition from using «pull» technology (students log onto a website and download files) to «push» technology (information is downloaded automatically if subscribed to the provider) (Harris and Krousgrill, 2008). It has been shown to be a successful supplement to traditional teaching in fields, such as engineering (Reynolds et al., 2008; Harris and Krousgrill, 2008), law (Shim et al., 2007), medicine (Nast et al., 2009; Shantikumar, 2009), tourism (Dale, 2007) and to varying degrees in the social sciences (Louw et al., 2009).

Trends in the use of ICT in higher education

In both the US and UK, podcasting («push» technology) was first used as an M-learning medium to supplement or aid in distance education (Shim et al., 2007). Duke University was a pioneer in the educational use of iPods: In 2004 the university distributed 1600 iPods devices to first year students to access course material (Duke, 2005; Harris et al., 2008). This programme was, however, limited by the amount of software products available for use by teachers, which resulted in a small amount of instructor-developed material being available to students (Harris and Krousgrill, 2008). Purdue University started podcasting lectures

for distance engineering students in 2006, students thus being able to use iPods or the Internet to view the material (Harris and Krousgrill, 2008). The use of podcasting has increased in universities in the UK (Harris and Park, 2008), with an expansion in its area of application, ranging from advertising for potential students (e.g. University of East Anglia), informing first-time users on how to use the library (e.g. Bristol and Loughborough Universities), broadcasting news to staff and students (e.g. Southampton University), updating law students in changes in the law (e.g. University of Sheffield), assistance for dyslexic students (e.g. University of Winchester), to publishing course material and course support material (e.g. University of Winchester) (Shim et al., 2007; Harris and Krousgrill, 2008).

The use of iPods has changed smoothly from entertainment to educational use. However, their successful use depends largely on whether academia can create content and delivery methods optimized for this application (Harris and Krousgrill, 2008). Research has shown that online lectures cannot replace face-to-face lecture attendance, but can potentially assist students in revision (Nast et al., 2009) and it is a useful tool in distance education (Harris and Krousgrill, 2008; Bingen and Aasbrenn, 2009). Podcasting is also expected to complement traditional teaching. Fernandez et al. (2009) and Reynolds et al. (2008) noted that podcasting provides a more personal, individual interaction with the web than webcasting.

Trends in the use of ICT in higher education in Scandinavia

In 1996, Myklebust states that students in some fields (medicine and engineering) in Nordic countries required computers to study whereas in other fields few students had or used them. This has changed significantly in the last decade, where contact between students and their teachers take place over the Internet in addition to in the auditorium. In Norway, webcasting and «pull» technologies are used extensively in higher education, in particular in distance education (Bingen and Aasbrenn, 2009). For example, Diakon University College uses ICT to deliver nursing lectures to both on- and off-campus students simultaneously (Bingen and Aasbrenn, 2009). The increasing availability of mobile technology and the popularity of «push» technology are resulting in pressure on higher education institutions in Nordic countries to incorporate this technology into their teaching repertoire. Therefore, teachers need to understand how to use new technologies to deliver teaching materials and lectures in the best manner.

Hypotheses of this study

This study's objective was to consider student perceptions of the use of ICT in teaching. Through a simple experiment we determined students' satisfaction with and perceived learning from three different types of lecture delivery: a standard auditorium lecture, a full-length film of the lecture («pull» technology) and a concise, downloadable podcast version (potentially «push» technology) of the same lecture. We hypothesized that students would be most satisfied with conventional auditorium lectures, and we predicted that students are least satisfied with a full-length film of lectures.

Methods

A 35-minute lecture was designed that could be presented to multiple groups of students in the Faculty of Social Sciences at Lillehammer University College. The lecture discusses the educational journey one undergoes throughout life, with special reference to students in higher education. With the use of two metaphors (a case study and a fairy tale – the story of the Ugly Duckling), the lecturer attempted to highlight how one can change through experience and that one needs to be present in the moment, knowing one's self. A short visual story depicting the fairy tale of the Ugly Duckling was presented at the end of the lecture. The lecture was designed to give students the possibility to reflect upon their own journey through the course of the studies such that they recognize their changes.

The lecture was given to three different groups:

- (1) Third year Social Education students received the lecture *in an auditorium* with an accompanying PowerPoint presentation,
- (2) postgraduate (Psycho-social Work with Children and Adolescents) students saw a *full length film* of the abovementioned lecture, and
- (3) postgraduate (Psycho-social Work with Children and Adolescents) students had access to a *podcast* (the lecture content shortened to 17 minutes and filmed as a separate entity to the original lecture) available as a podcast or webcast (only pull-technology as it had to be downloaded).

A questionnaire was completed directly after the lecture (Groups 1 and 2) or collected when students met for a lecture a week after the podcast was made available to the students (Group 3). The questionnaire for Group 3 included four additional questions regarding the use of material available on the Internet (Appendix 1). Answers from the questionnaires were categorized and results were analyzed using the statistical software Graph Pad Prism (2003).

Results

Group 1 (in an auditorium)

We received 51 responses from 80 students from Group 1 (in an auditorium). Of the students in this group, 59 percent and 29 percent thought they had followed the lecture well and very well, respectively. The degree to which students perceived that they had learned something from the lecture was high, with 47 percent answering a large amount of learning and 31 percent noting maximum learning. Of the students, 33 percent wrote that they remembered the visualized fairy tale of the Ugly Duckling best, and 27 percent responded that they remembered an interpretation of or reflection on this story best. There were 46 percent of the students who noted that they liked the interpretations of the Ugly Duckling» and the use of metaphors best, whereas there were 13 percent who liked the film. The students were positive towards the lecture, 51 percent noted that there was nothing that they did not like. When asked what the students immediate feelings were, 31 percent noted no certain feelings, 39 percent noted some type of positive reflection, 5 percent noted good feelings about the lecture, whereas 14 percent noted something negative (boredom, little benefit or confusion).

Group 2 (full-length film)

We received 9 responses from 12 students from Group 2 (full-length film). Of the students, 67 percent rated that they followed the lecture quite well and completely. The degree to which students perceived that they had learned something from the lecture was low, with 44 percent noted a small amount of learning and 22 percent noting minimum learning. This group was more reflective about the lecture content than the first group, all answers regarding what the students remembered best noted some reflection on the lecture content. Seventy-eight percent of the students liked the use of metaphors and the reflection on the journey one takes through education. Twenty-two percent liked the film. A third of the students noted that they found the lecture boring and not particularly engaging, three disliked the poor sound quality and two disliked the visual story at the end. Of the students, 78 percent noted a negative feeling after the film (they felt tired or bored and felt that there was little to engage them). One student responded with a good and positive reflection towards the lecture.

Group 3 (podcast)

None of the 39 students in Group 3 (podcast) downloaded and watched the shortened podcast of the lecture. Therefore we have no results to compare with the previous groups.

Discussion

The experiment we conducted was an attempt to determine student response and learning quality from three different forms of teaching: an ordinary lecture with a PowerPoint presentation, a film of this lecture (an example of a lecture delivered over the Internet as a webcast) and a short podcast of the lecture (available as a download).

Student satisfaction

Our study shows that students are more satisfied with a lecture in the auditorium than with a film of the same lecture. The students found the film less engaging and perceived learning was less. The observed differences in responses between Group 1 (in an auditorium) and Group 2 (full length film) may be a consequence of the different modes of communication. A lecture is a two way performance, where the student's response, or lack thereof, will affect both the content of the lecture and the way it is presented (Nordkvelle et al., 2009). A lecture given in an auditorium is an emotional, social, cognitive and visual experience where the lecturer's use of varied voice, movement, addressing the students with questions, stories or humor makes the students attentive and creates an effective learning environment (Nordkvelle et al., 2009). A filmed lecture, however, provides no opportunities for the students to react to the lecturer, lecture material or the way the information is delivered (Fritze and Nordkvelle, 2003). Furthermore, webcasts of lectures or podcasts are experienced on a computer screen or mobile device in a version of the lecture's reality which has been filtered through several technological processes and has been subjected to many choices made by the producers of the film. Therefore, personal reactions to the film cannot be the same as those to the lecture given in an auditorium.

Student motivation

The students in Groups 2 (full length film) and 3 (podcast) were part-time students who we assumed would benefit from extra teaching material (in the form of webcasts or podcasts) being available over the Internet. The lecture content was relevant to all three groups of students, such that it should have encouraged them to reflect on their personal situation within the system of the course they were taking. Therefore, it was relevant to them as support information («reading around the topic») to their examinable coursework. Consequently, we assume that a lack of motivation was the major cause of students in Group 3 not viewing the podcast.

The podcast lecture was made available a week before the intended execution of the questionnaire for students in Group 3 to download and view in their own time. Despite the fact that the students were informed of the availability of the podcast lecture and that they were strongly encouraged and instructed to view it, none downloaded and saw it. Delivery method of podcasts is likely to influence student motivation to view them. For example, in our study the podcast was delivered via «pull-technology» (lecture available as a downloadable podcast or webcast) rather than «push-technology» (automatically downloaded podcast), which requires a greater degree of student engagement.

The lack of response from Group 3 makes us question the use of ICT in different academic fields and different student groups. We chose social science students for our study, but the use of ICT (webcasts and podcasts) may be better suited to the natural sciences, particularly medicine or dentistry (Nast et al., 2009; Shantikumar, 2009), where viewing and revising a procedure or experiment may be particularly beneficial for revision purposes.

Furthermore, it is clear from the responses from the students who watched the full-length film of the lecture that if they had viewed it on their own in a less organized setting, they would have stopped or only seen parts of the lecture. The students' negative response to the film and their lack of response to the podcast makes one question whether the use of web- and podcasting in teaching is limited by student motivation. Podcasts of modified lecture content (either pre- or post-lecture) may, however, assist and be valuable in student learning as teasers to attract students to lectures or for the repetition of the vital facts.

Technical implications

The film (webcast or podcast) lectures were less engaging than the lecture given in the auditorium. This may be due to poor sound and picture quality (as a consequence of the film itself or the device it was viewed on) (Fritze and Nordkvelle, 2003). For example, in the filmed lecture in our study, the sound of the visualized fairy tale had a notably poorer quality than the remainder of the lecture. Nevertheless, only 33 percent of the students that watched the film complained about poor sound quality and technical problems, and therefore it seems reasonable to assume that film quality in this study did not greatly influence student engagement in the lecture material.

Poorer sound quality in the visualized fairy tale compared to the remainder of the film may also be the reason why the students who saw the film of the lecture did not like it as much as the group of students who attended the lecture. However, in this case the use of a

visual story within a film may not engage viewers as much as seeing a visual story within a live lecture.

Although sound and picture quality was not considered to be a large problem to the group of students who watched the filmed lecture, one needs to consider other aspects of the film production that may influence student engagement. Students in the group that received the lecture in an auditorium did not refer directly to being disturbed by the presence of a camera and a cameraman (which included the movement of the camera whilst panning, zooming, etc.), but they can be an intrusion which negatively affects student experience of a lecture. Moreover, the lecturer's teaching behavior may also be influenced by the filming process such that the lecturer's voice or animation may be different to a lecture given without being filmed.

In addition, the filming process is costly – both in terms of the cost of manpower (a lecturer and someone to film the lecture) and post-filming technical production. Consequently, to take full advantage of the new technologies available, teachers may need to learn new skills (Strømsø et al., 2007), and potentially spend more time preparing course material that is applicable for both the classroom and M-learning.

The film produced for our study was a single-camera production, where the cameraman panned between view of the lecturer and the slide presentation. However, Griffin et al. (2009) noted that using an audio-visually synchronized (a combination of lecturer presenting and slides) provides a pedagogical benefit when delivering Internet-based teaching materials. This type of production is made possible through the use of web-cameras and «lecture capture and retrieval» software amongst others (Corbyn, 2009). This reduces the amount of manpower required for producing teaching material for M-learning. It is important to note that the quality of film produced by web-cams and the stationary behavior of a lecturer (Fritze and Nordkvelle, 2003) may reduce the level to which students are engaged, no matter what topic is being presented. Nevertheless, this technology may be the best available to date for creating lecture material for distance students.

Future directions

We found that students were more satisfied with a face-to-face lecture, and they perceived that they learned more than students that watched a filmed version of the same lecture. In addition, we found that students did not watch a shortened, podcast version of the lecture made available via the Internet. We assume that this is due to lack of student motivation. Therefore, we recommend that before embarking on a costly (in terms of both time and money) M-learning adventure, lecturers consider the purpose and the content of the material they wish to make available to their students. Another point worth consideration is whether the cost of production can be made up through improved learning and test results from the students. As previously mentioned, ICT has been found to be beneficial to distance learning (Harris and Krougrill, 2008) and for revision (Reynolds et al., 2008; Harris and Krougrill, 2008; Shim et al., 2007; Nast et al., 2009; Shantikumar, 2009; Dale, 2007; Louw et al., 2009). However, the progression of the use of ICT in higher education has been slow (Strømsø et al., 2007), and in order to fully take advantage of ICT in teaching, we sug-

gest that future research should focus on (i) how to implement greater use of ICT in teaching, (ii) how much information teachers need to make available, (iii) what form this information needs to be in and, (iv) how much time and resources should be invested in implementing these new technologies.

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References

- Apple. www.apple.com/hotnews/. Accessed 04052010.
- Bingen, Hanne Maria and Aasbrenn, Martin (2009): Fleksibel undervisning. *UNIPED*, 32(3), 68–77.
- Corbyn, Zoe (2009): Threat to virtual worlds but silver lining for cloud email: Second life out as techies embrace cloud email. *Times Higher Education*, <http://www.timeshighereducation.co.uk/story.asp?storycode=407839>.
- Dale, Crispin (2007): Strategies for using podcasting to support student learning. *Journal of Hospitality, Leisure, Sport and Tourism Education*, 6(1), 49–57.
- Duke (2005): *Duke digital initiative (online)*. Available online (accessed 1 September 2009).
- Evans, Chris (2007): The effectiveness of m-learning in the form of podcast revision lectures in higher education. *Computers and Education*, 50, 491–498.
- Fernandez, Vicenc, Simo, Pep and Sallan, Jose M. (2009): Podcasting: A new technological tool to facilitate good practice in higher education. *Computers and Education*, 53, 385–392.
- Fritze, Yvonne and Nordkvelle, Yngve T. (2003): Comparing lectures: Effects of the technological content of the studio. *Education and Information Technologies*, 8(4), 327–343.
- Griffin, Darren K., Mitchell, David and Thompson, Simon J. (2009): Podcasting by synchronising PowerPoint and voice: What are the pedagogical benefits? *Computers and Education*, 53, 532–539.
- Harris, Dale A. and Krousrill, Chuck (2008): Distance education: New technologies and new directions. *Proceedings for the IEEE*, 96(6), 917–930.
- Harris, Howard and Park, Sungmin (2008): Educational usages of podcasting. *British Journal of Educational Technology*, 39(3), 548–551.
- Louw, Johann, Brown, Cheryl, Muller, Johan and Soudien, Crain (2009): Instructional technologies in social science instruction in South Africa. *Computers and Education*, 53, 234–242.
- Myklebust, Margit Lea (1996): State-of-the-art of computer-aided learning in the Nordic countries. *European Journal of Engineering Education*, 21(3), 309–316.
- Nast, Alexander, Schäfer-Hesterberg, Gregor, Zielke, Hendrik, Sterry, Wolfram and Rzany, Berthold (2009): Online lectures for students in dermatology: a replacement for traditional teaching or a valuable addition? *JEADV*, 23, 1039–1043.
- Nordkvelle, Yngve T., Fritze, Yvonne and Haugsbakk, Geir (2009): The visual in teaching – from Bologna to YouTubeiversity. *Medien – Wissen – Bildung*. University of Innsbruck.
- Reynolds, Patricia A., Mason, Robin and Eaton, Kathryn A. (2008): Webcasting: Casting the web more widely. *British Dental Journal*, 204(3), 145–149.

Shantikumar, Saran (2009): From lecture theatre to portable media: Student's perceptions of an enhanced podcast for revision. *Medical Teacher*, 31, 535–538.

Shim, Julie P., Shropshire, Jordan, Park, Sungmin, Harris, Howard and Campbell, Natalie (2007): Podcasting for e-learning, communication, and delivery. *Industrial Management and Data Systems*, 107(4), 587–600.

Strømsø, Helge I., Lycke, Kirsten H. and Lauvås, Per (Eds.) (2007): *Når læring er det viktigste. Undervisning i høyere utdanning*. Oslo: Cappelen Akademiske Forlag.

Säljö, Roger (2002): *Lärande i det 21:a århundradet*. I Roger Säljö and Jonas Linderöth (Eds.): *Utm@ningar och e-fristelser*. Stockholm: Prisma.

Appendix 1)

Questionnaires used in this study

Questionnaire given to Groups 1 and 2

1. How correct do you feel this statement to be? «I followed the lecture 100 %».

Not at all Little Medium Quite Completely
2. How much do you feel you learned?

Nothing Little Medium Large Maximum
3. What do you remember best from the lecture?
4. What did you like the most?
5. What did you like the least?
6. What are your immediate feelings?

Questionnaire given to Group 3

1. Have you seen the entire film? Yes No
2. How many times have you seen the film? 1 2 3 4 5 more
3. Did you see parts of the film more than once? Yes No
4. If yes, which parts did you see more than once?
5. How correct do you consider this statement to be? «I followed the lecture 100 %».

Not at all Little Medium Quite well Completely
6. How much do you feel you learned?

Nothing Little Medium Large Maximum
7. What do you remember best from the lecture?
8. What did you like most?
9. What did you like least?
10. What are your immediate feelings?